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IRRIGATION AMONG THE GREEKS AND THE ROMANS

Last year, having been invited to address the Geology Club of Barnard College, I recalled that some time before, when I attended a meeting of that Club, an address was made on irrigation in the Western parts of our own country. I planned, then, to address the Club on Irrigation in Classical Times and Lands. But, on investigation, I discovered that it finds no place in certain standard handbooks of classical antiquities. The long article, *Agricultura*, in Smith, *Dictionary of Greek and Roman Antiquities*³ (London, 1890), contains not a word about irrigation. Equally silent on the subject is the article entitled *Landwirtschaft*, in Friedrich Lübker's *Reallexikon des Klassischen Altertums*, eighth edition, by J. Geffcken and E. Ziebarth (Teubner, Leipzig, 1914). There is no discussion of Greek agriculture in Whibley, *A Companion to Greek Studies*, and no reference to irrigation in the all too brief account of Roman agriculture in Sandys, *A Companion to Latin Studies*.

In the article *Ackerbau*, by Hugo Blümner, in Baumeister, *Denkmäler des Klassischen Altertums*, 1.10, reference is made, briefly, to irrigation in ancient times. In Pauly-Wissowa, *Realencyclopädie der Classischen Altertumswissenschaft*, in the article *Ackerbau*, by F. Olck (1894), Volume I, First Half, Column 267, in the account of Greek agriculture, 23 lines are devoted to irrigation and drainage together; in columns 278-279 irrigation and drainage in Roman agriculture are discussed together, in an even worse jumble. In the part that relates to Greek irrigation, the most important statement runs as follows:

Die Irrigation im kleinen wurde bei eigentlichem Ackerlande wohl nur selten angewandt, besonders bei der Hirse vermittelt kleiner Wasserfurchen. Xen. an. II 4, 13. Geop. II 38, 1.

In the article on Agriculture in the *Encyclopedia Britannica*¹¹, less than a page is devoted to the agriculture of ancient Greece and ancient Rome. Nothing at all is said of irrigation in Greece. There is one reference to irrigation as practiced by the Italians, in a translation of a passage in the first book of the *Georgics*. The *Britannica* again, in the article on Irrigation, contains but a single reference of the most fugitive sort to irrigation in Greece and Italy.

Stranger than all this, however, is the fact that there is no systematic discussion of irrigation in Cato's

De Agri Cultura, or in Varro's *De Re Rustica*. That Columella refers to the matter will appear later.

It appears, then, that in the books, ancient and modern, to which one naturally turns first in connection with this subject, one finds little or no help. It seems worth while, therefore, to group passages I have found in ordinary reading in which reference is made by Greek or Latin writers to irrigation, and to combine with these a few additional passages, from Columella and the Digest, supplied by Pauly-Wissowa.

Herodotus 1.193 declares that the land of the Assyrians lacks water but that there is rain enough to make the grain sprout. The ripening, however, of the grain is due, he continues, to water from the river, that is, to irrigation. This water, he adds, is not, as in Egypt, supplied by the action of the river itself, but by sweeps worked by hand.

'Babylonia, like Egypt, is everywhere cut up into canals. The largest of these is navigable. Babylonia is the best of known lands for the production of the fruits of Ceres. . . . It bears grain so richly that it yields two hundred fold, and sometimes, at it best, three hundred fold'.

We may compare Pliny, N. H. 18.161:

Babyloniae tamen bis secant <frumentum, segetes>, tertium depascunt, alioquin folia tantum fierent. Sic quoque cum quinquagesimo faenore messis reddit eximia fertilitas soli, diligentioribus verum cum centesimo. Neque est cura difficilis quam diutissime aqua rigandi, ut praepinguis et densa ubertas diluatur. Limum autem non irvehunt Euphrates Tigrisque, sic ut in Aegypto Nilus, nec terra ipsa herbas gignit. Ubertas tamen tanta est ut sequente anno sponte restibilis fiat seges, impressis vestigio seminibus. . .

Strabo, 16.1.9-10, when dealing with the alluvial plain of the Tigris-Euphrates basin about Babylon, had discussed irrigation, and had shown "an unusually clear knowledge of the whole process of river irrigation", according to Professor W. L. Westermann, *Classical Philology* 12.240, in an article to which other references will be made below. Professor Westermann argues (241-242) that Strabo derived his knowledge not from any ancient scientific treatise upon the subject (we know of no such treatise, he says), but from travel in Egypt with his friend Aelius Gallus, during whose prefecture in Egypt, 27-24 B.C., Augustus cleared out the irrigation ditches in Egypt (see below).

The passage cited above from Herodotus makes one think of Xenophon, *Anabasis* 1.7.14. There we read that, as Cyrus and the ten thousand Greeks were nearing Babylon, they came one day to a 'trench', thirty

feet broad and eighteen feet deep. This 'trench' had been carried inland across the plain for about thirty-six miles to the Wall of Media. Then come sentences which, because they interrupt the narrative, many editors regard as an interpolation, from the notes of some editor or copyist. They may be translated as follows:

'Here are canals, flowing from the river Tigris; they are four in number, each one hundred feet broad, and very deep, and grain-bearing vessels sail on them. They empty into the Euphrates. They are about three miles apart, and there are bridges on them'.

Of the 'trench', referred to above, Xenophon now says that the King of Persia had built it, when he heard of Cyrus's coming, to serve as a line of defense. There was a passage only twenty feet wide between the trench and the river Euphrates.

But let us return to the bracketed words concerning the canals. They have to do with the irrigation work in Babylonia. Evidence enough in support of this work is to be found in the *Anabasis* 2.3.10:

'They came upon ditches and channels full of water, so that it was not possible to cross them without bridges. These bridges they made in part out of fallen palm trees, in part out of trees which they felled for the purpose'.

This passage means that the Greeks, now on their way home under the guidance of the Persians, had come upon the elaborate system of irrigation whereby the natural fertility of Babylonia was increased. In paragraph 13 of this chapter we read that Klearchus made all possible haste, 'because he suspected that the ditches were not always thus full of water, for it was not yet the time to irrigate the plains'. It was now October, and the time for irrigation was, of course the summer. Xenophon adds that Klearchos suspected that the King had let the water into the plain, in order that the Greeks might at once find themselves confronted with all sorts of difficulties with respect to their homeward journey.

In 2.4.13 Xenophon writes as follows:

'Presently they crossed two canals, the first by a regular bridge; the other was spanned by seven boats. These canals issued from the Tigris, and from them a whole system of minor trenches was cut, leading over the country—larger ones to begin with, and then smaller and smaller, till at last they became the merest runnel; like those in Greece used for watering millet fields'.

In Euripides, *Medea* 824-842 we have the famous passage in which the poet sings the praises of Athens:

'Happy indeed from days of old are the sons and the daughters of Erechtheus, and children are they of the blessed gods, feeding on the most glorious wisdom of a holy land, a land never ravaged, and ever pacing lightly through air most brilliant, in a land where the Pierian Muses, the stainless Nine, bore fair-haired Harmonia. And story tells, too, how, drawing the streams from Cephissus, the lovely-flowing Cephissus, the lady of Cyprus breathes o'er Attica breezes, well controlled, sweet-scented <and dewy with the waters of the Cephissus>, and they tell also that **always**, flinging about her tresses fragrant wreathes of rose-flowers,

she sends to Athens the Loves, assessors of wisdom, coworkers of virtue of every sort'.

Here we have, as Professor Earle remarked in his notes, "irrigation poetized". The Cephissus is the main stream of Athens; the Ilissus, in modern times at least, has been a mere brooklet, except in heavy rains. Attic farmers, ancient and modern, cut irrigating channels from the Cephissus. Baedeker, *Greece*⁴ (1909), says, on page 97:

"The water of the Cephissus is exhausted by irrigation before it reaches the sea".

See also E. A. Gardner, *Ancient Athens*, 7, 16, 135; C. H. Weller, *Athens and its Monuments*, 18.

In Aristophanes, *Nubes* 282, the chorus of clouds, entering, says:

'Let us soar from the deep-sounding bosom of Father Ocean to the leaf-tressed peaks of the lofty hills. There, from some height that gives wide vision, let us look down on the sacred land with its watered grain'.

Other references to irrigation may be found in Theophrastus, in the work entitled in English, *On the Causes of Plants*, 3.6.3; Plato, *Laws*, Book 8, 844 A. Pauly-Wissowa adds Plato, *Laws*, Book 6, 761.

There is a story, found in a fragment of Hesiod, and in Strabo 1.2.15, that Danaus, by discovering subterranean reservoirs of water, made 'Argos have water which before was unwatered'. This story may, though it need not, imply irrigation.

Strabo (4.6.7), in describing the gold mines in the country of the Salassi, states that they used the river Durias (now the Dorea Baltea) in washing the gold; indeed, they emptied the main bed of the river by the trenches they cut to draw the water to various points to aid in gold washing. This operation, though advantageous in gold hunting, hurt agriculture below, by depriving farmers of the use of this high lying river for irrigation purposes.

Plutarch, *Themistocles* 31, tells us that Themistocles, when he was Water Commissioner at Athens, had caused a statue known as the Water-Carrier, a maid in bronze, two cubits high, to be made, out of the fines he exacted from those whom he convicted of tapping and stealing the public water. This *may* refer to irrigation (compare the allusion, cited below, in Middleton, *Remains of Ancient Rome* 2.119, to mention of a like matter by Frontinus). C. K.

(To be concluded)

THE PLACE OF WINCKELMANN IN THE HISTORY OF CLASSICAL SCHOLARSHIP¹

The ninth of December, 1917, was the two-hundredth anniversary of the birth of Johann Joachim Winckelmann, who has been called the founder of the scientific study of classical archaeology and the father of the

¹An expansion of a few paragraphs from the author's paper, *The Two-hundredth Anniversary of Winckelmann*, in *The Monist* 28.76-122 (January, 1918).